Single Muon Spectrum from Charm Decays in 200 GeV Au+Au Collision for STAR

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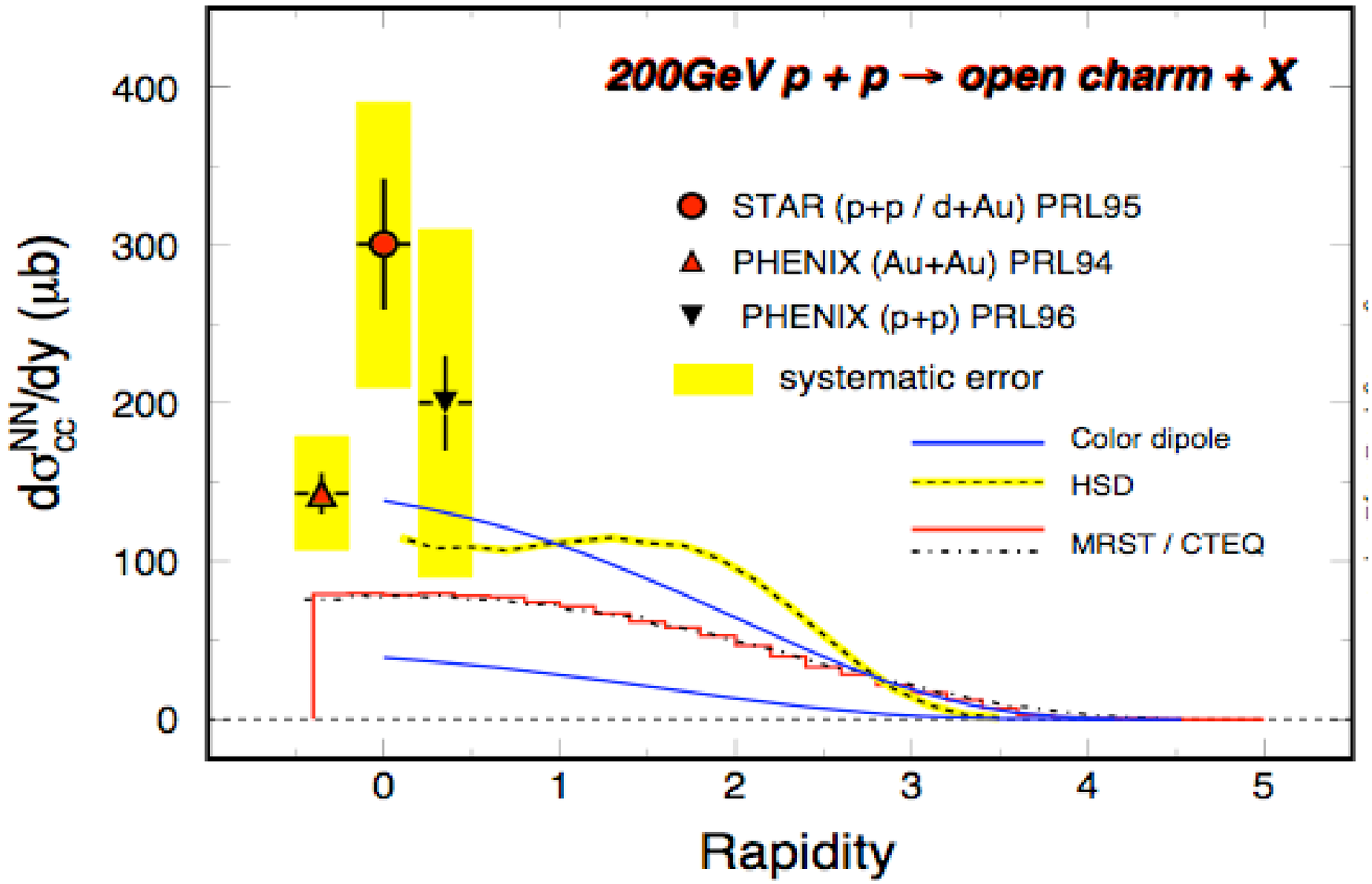
OutLine

- Motivation
- Charm measurement at STAR
- Data Analysis
- Results
- Summary

Motivation

- In relativistic heavy-ion collisions, charm quarks are believed to be produced at early stages via initial gluon fusions.
- Study of the Nbin scaling properties of the charm total cross-sectioo can test whether the charm quarks as a probe are produced exclusively at the initial impact.

Motivation



First set of measurements, systematic errors are large.
Precision data are needed

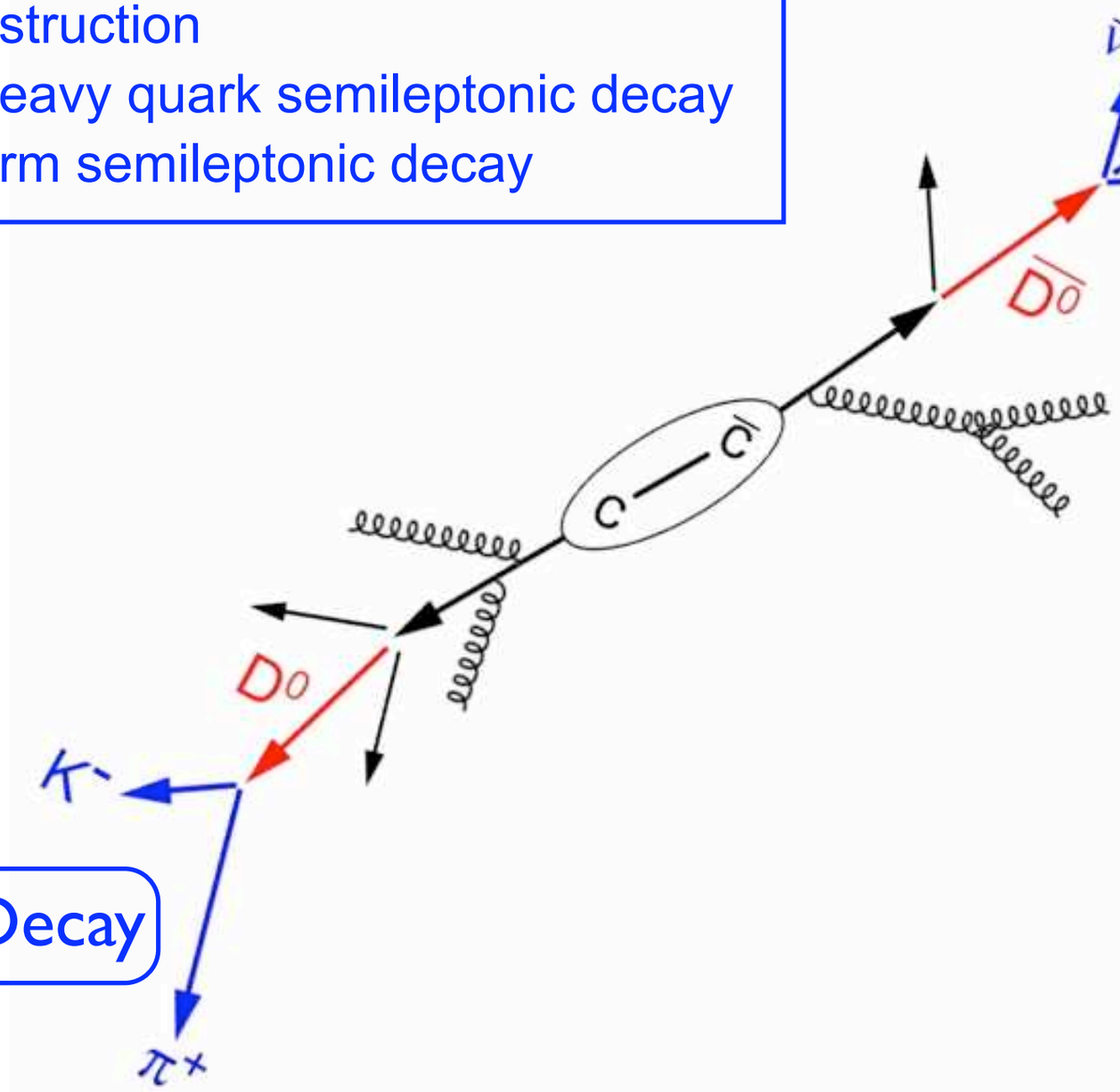
Charm measurement

Charm measurement at STAR

- ✓ Direct D^0 reconstruction
- ✓ electron from heavy quark semileptonic decay
- ✓ muon from charm semileptonic decay

Leptonic Decay

e^- or μ^-



$D^0 \to e^+ + anything$ Branch Ratio: $(6.87 \pm 0.28)\%$

$D^0 \to \mu^+ + anything$ Branch Ratio: $(6.5 \pm 0.8)\%$

Hadronic Decay

Charm measurement

Charm measurement at STAR

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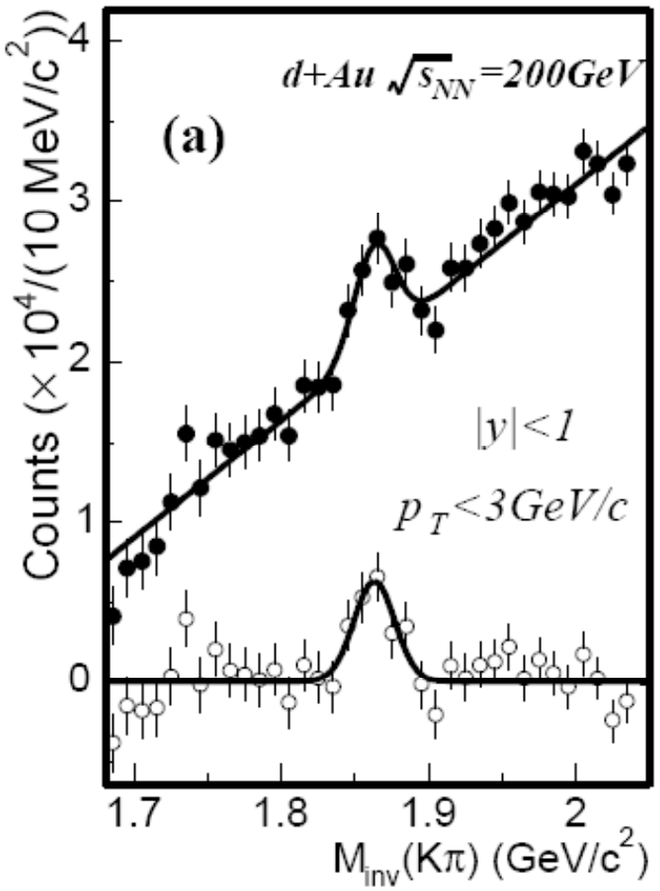
- ✓ electron from heavy quark semileptonic decay
- ✓ muon from charm semileptonic decay



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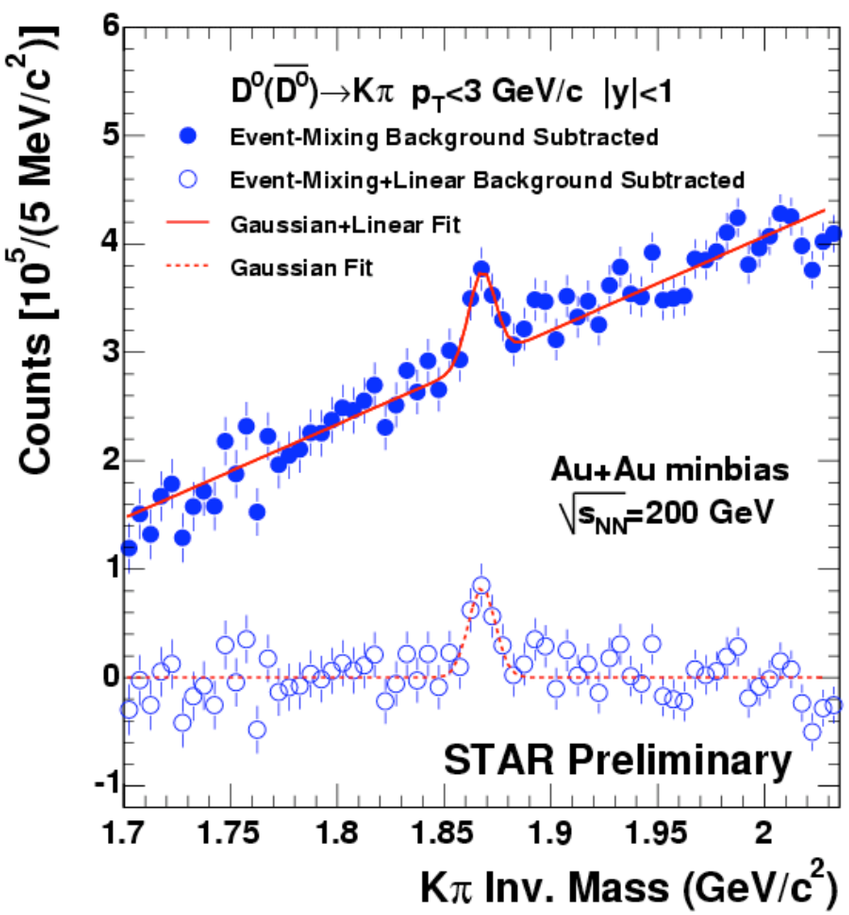

QM05 nucl-ex/0510063

Charm measurement

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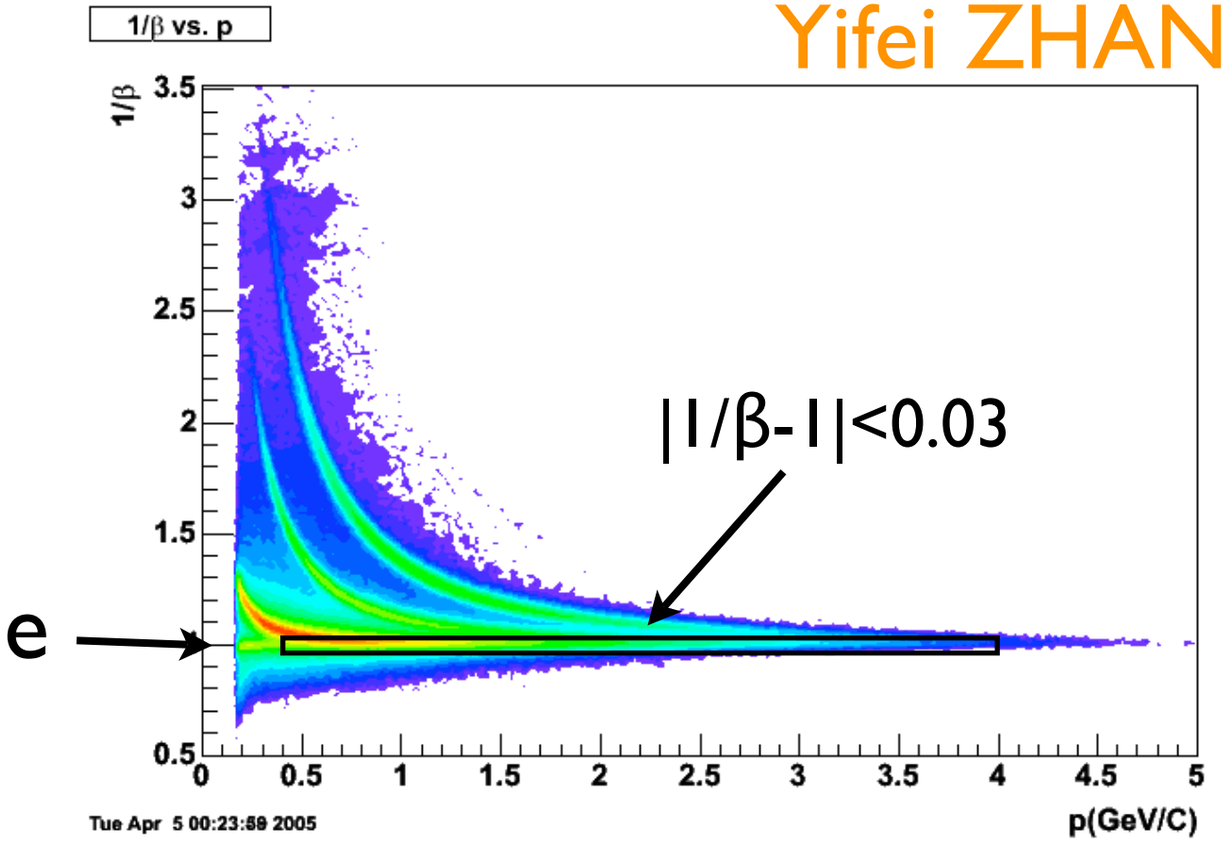

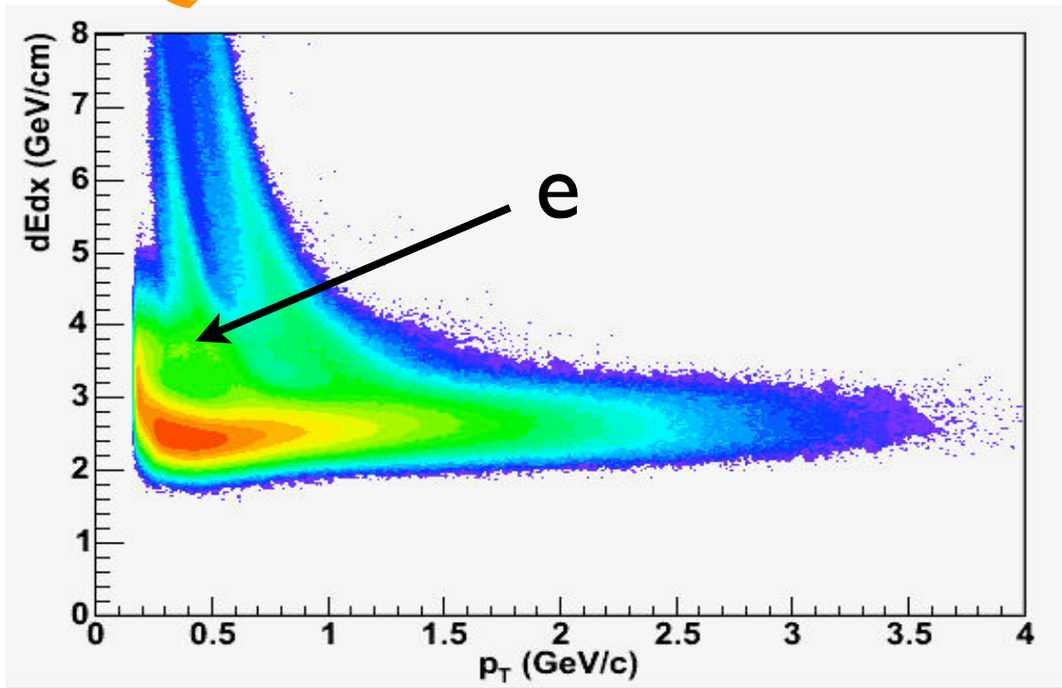

TOF - Particle velocity β

TPC - particle energy loss

Charm measurement

Charm measurement at STAR

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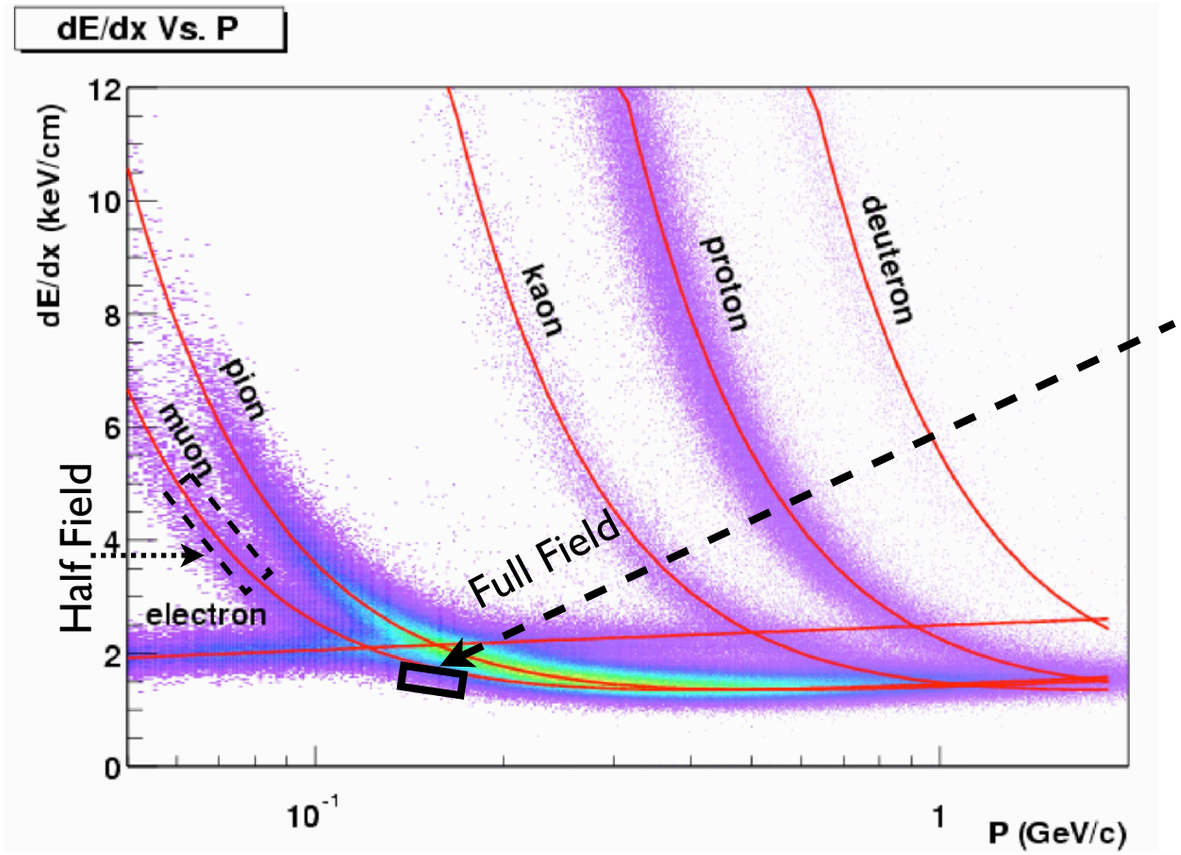
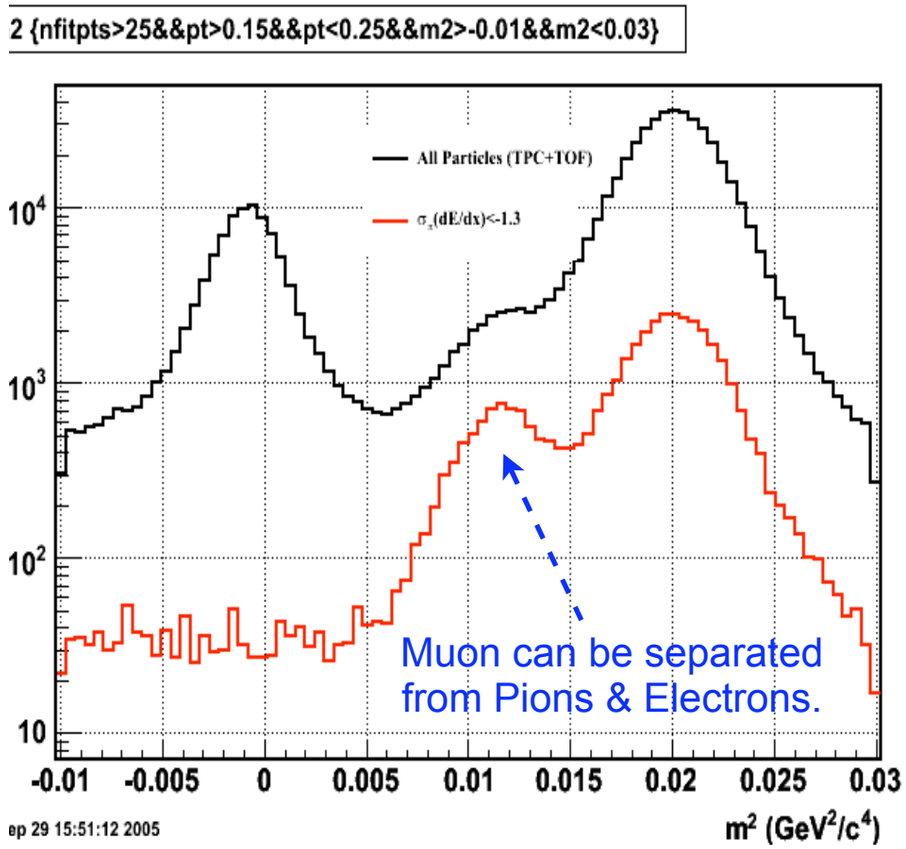
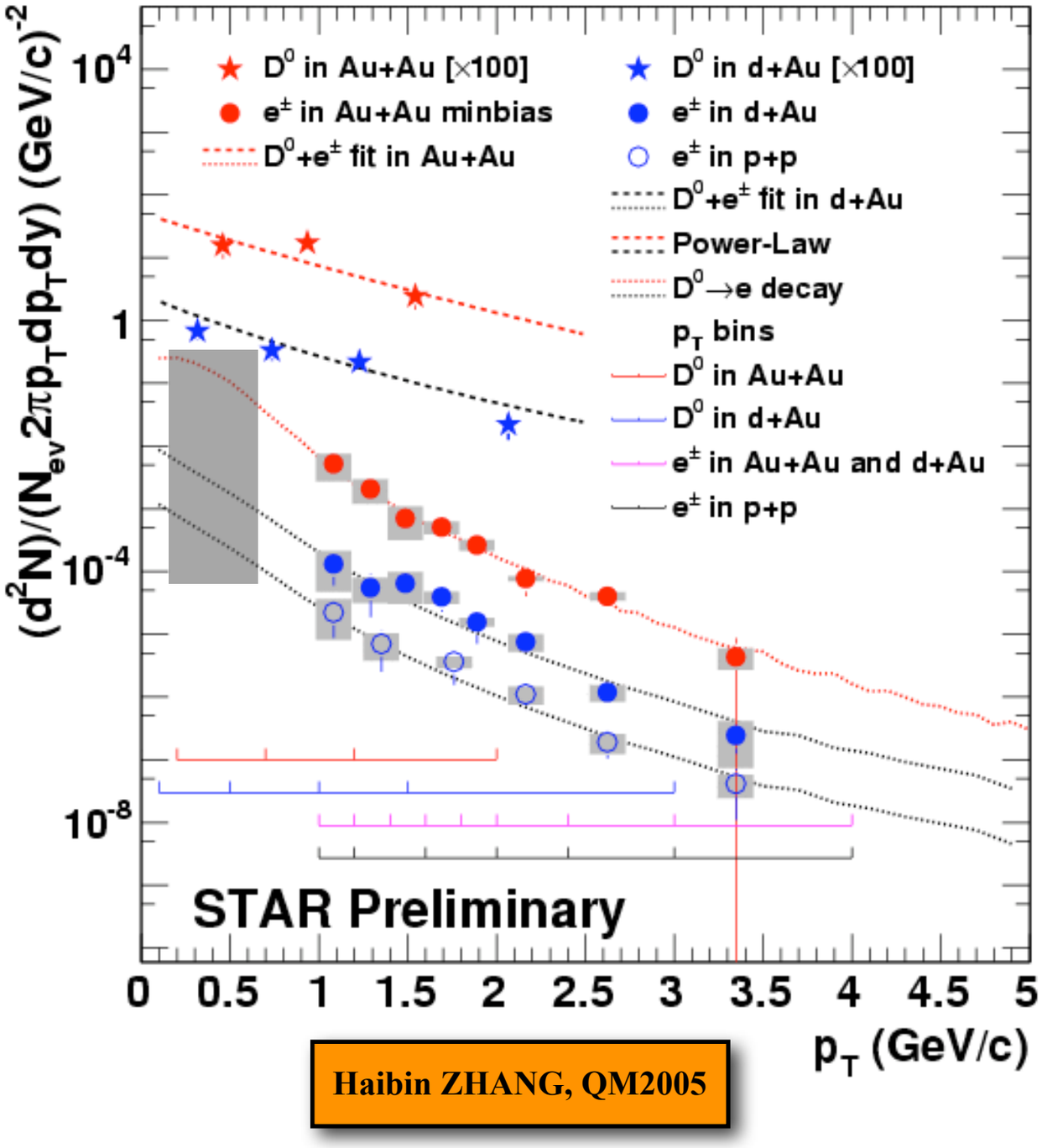


STAR TPC dE/dx spectrum



m^2 spectrum

Charm measurement



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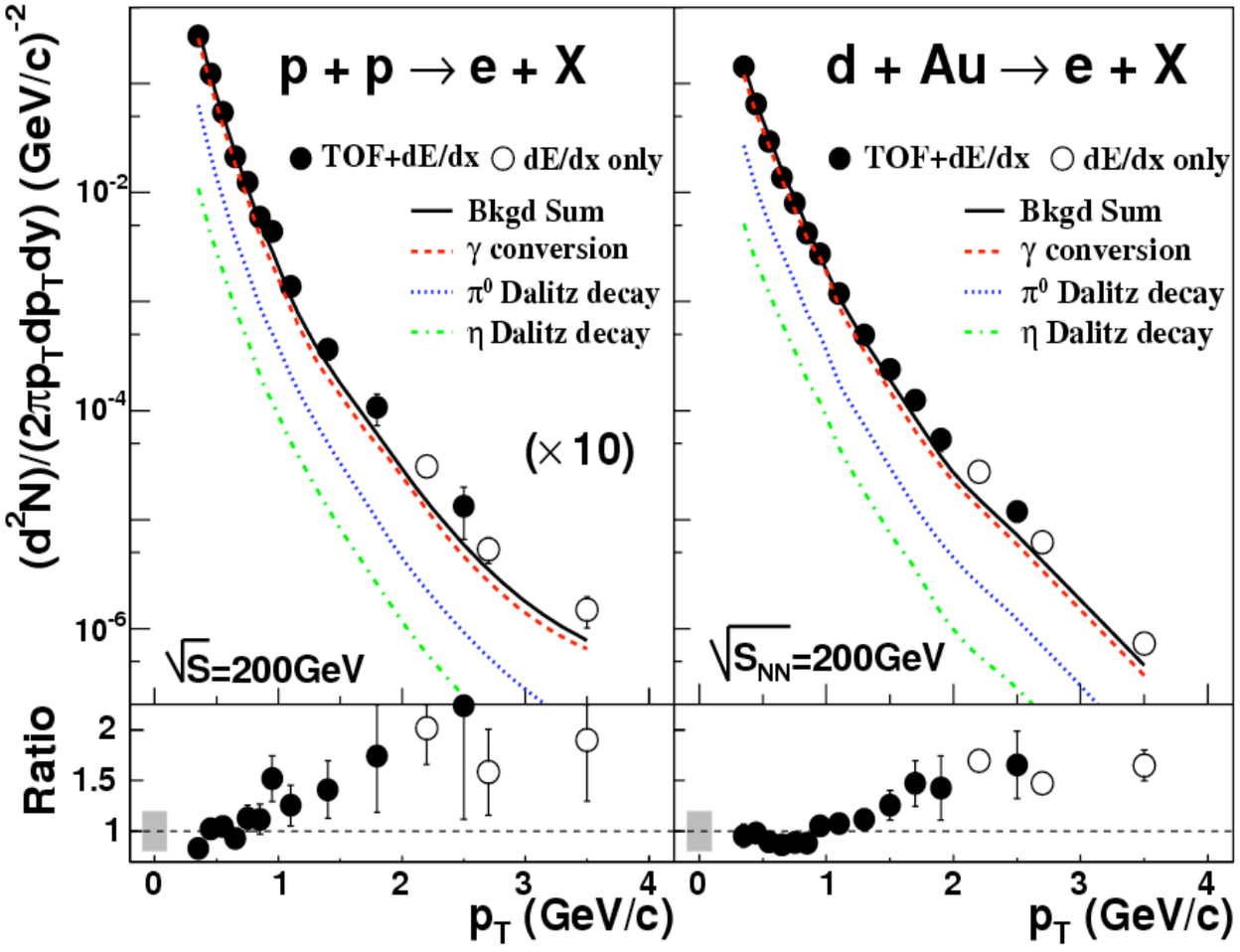
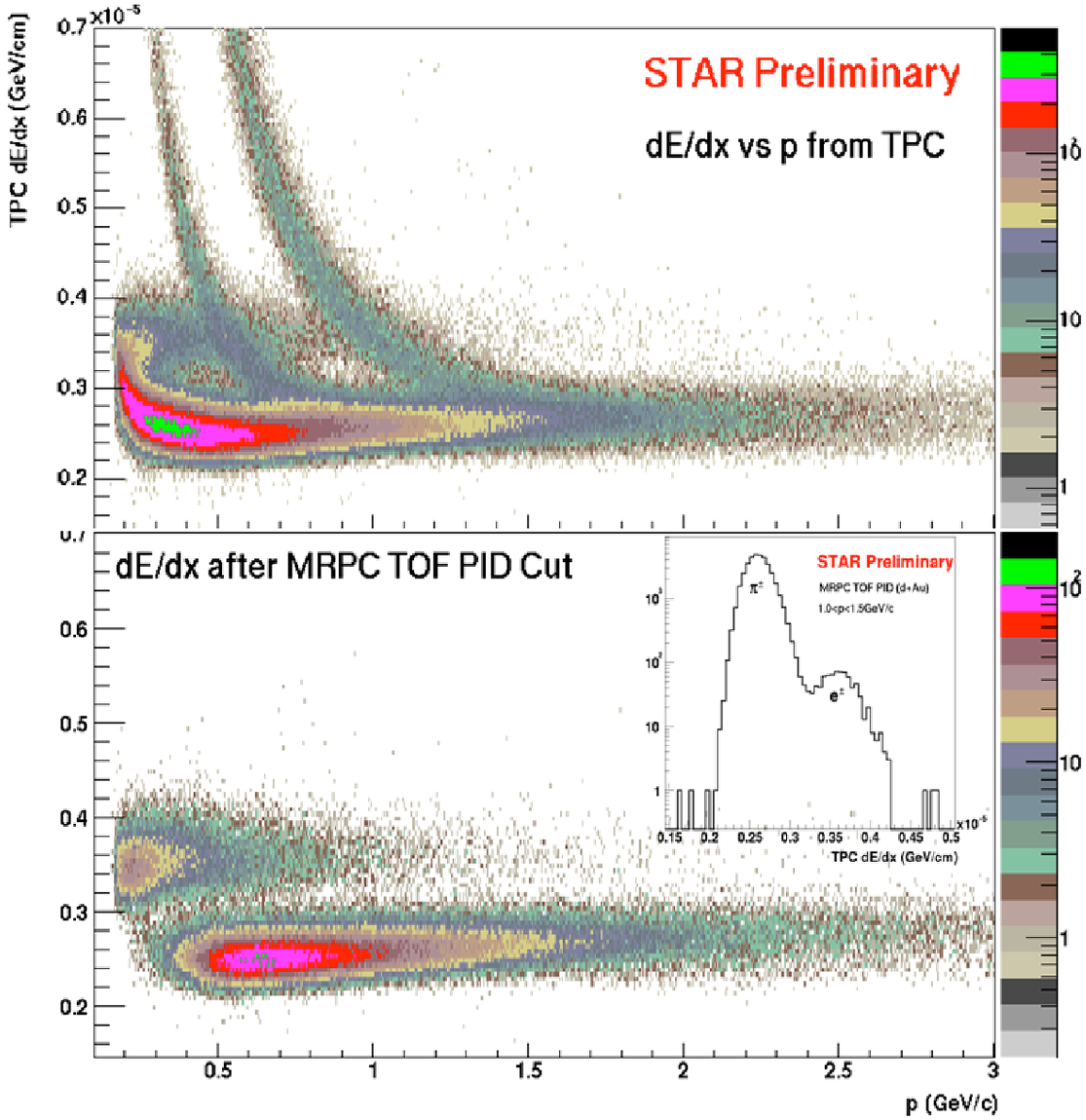


- Too much gamma conversions and Dalitz decays at low pT
- Charm and other sources < few percent

Time of Flight



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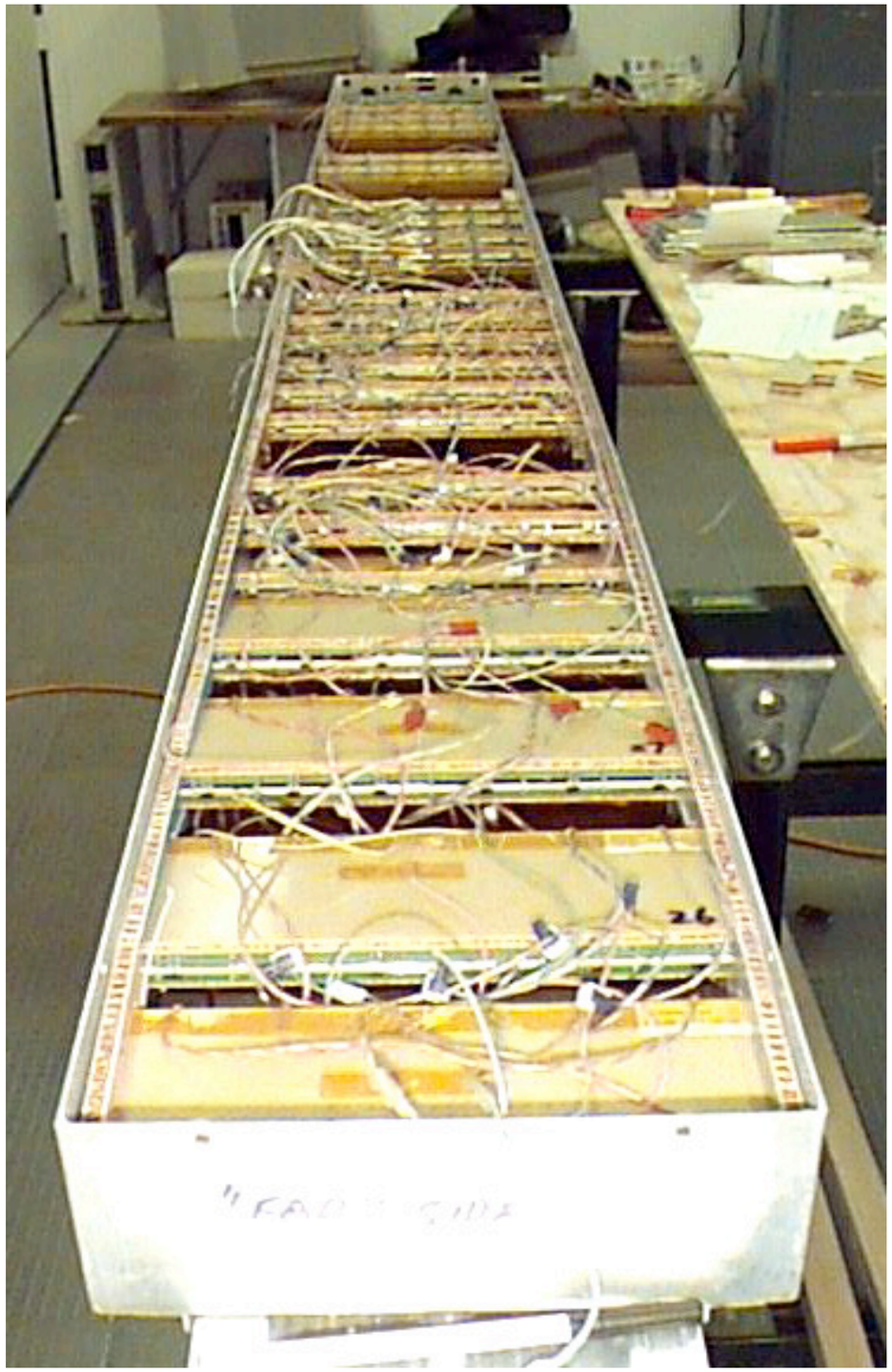


Data Set

DATA SET	minbias (0~80%)	central (0~12%)
Au Au 200 GeV Run IV P05 Full Field production		
Detectors	TPC, TOF	
Events	7.8 M	15.1 M
Tracks	9.3 M	47 M
nFitPoints	>= 25	>= 25
IVzI	< 30 cm	< 30 cm
Eta	[-1,0]	[-1.0]
we set three pT bins 0.17~0.21 0.21~0.25 0.25~0.27 GeV		

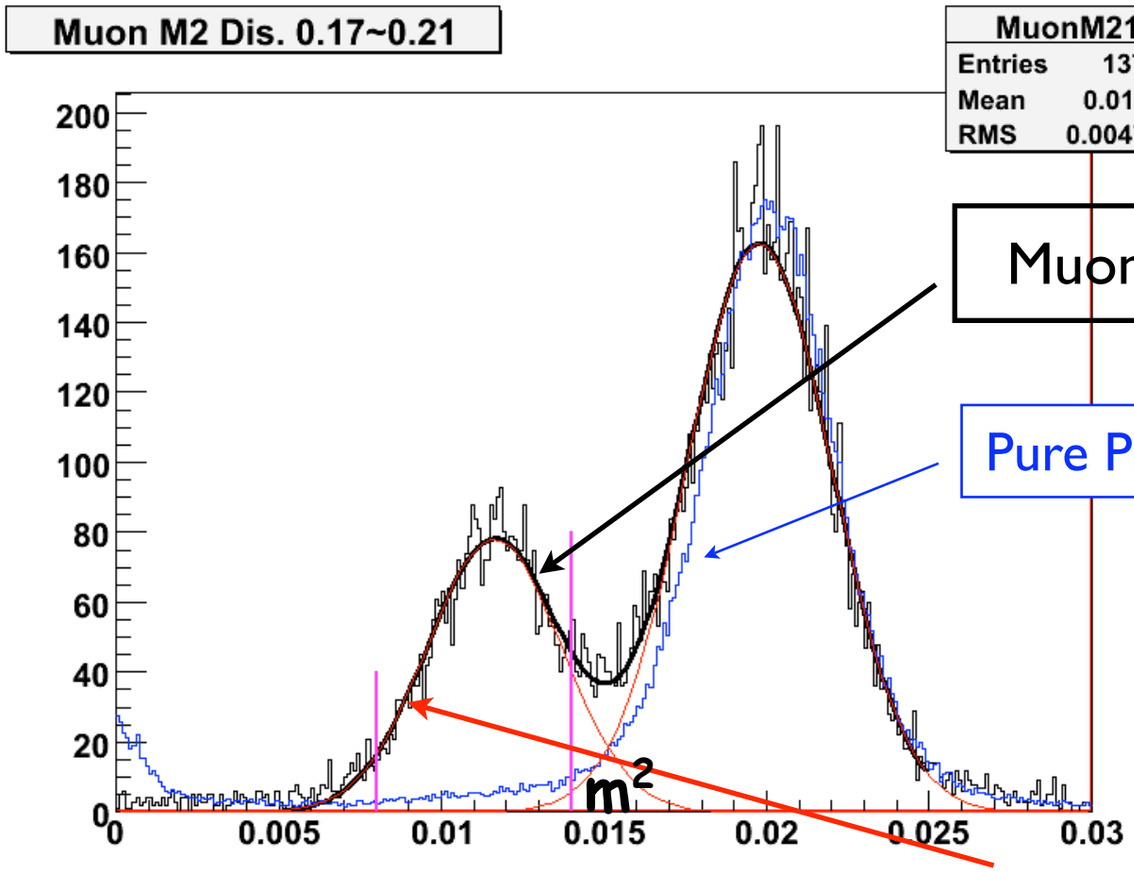
Simulation/Embedding data

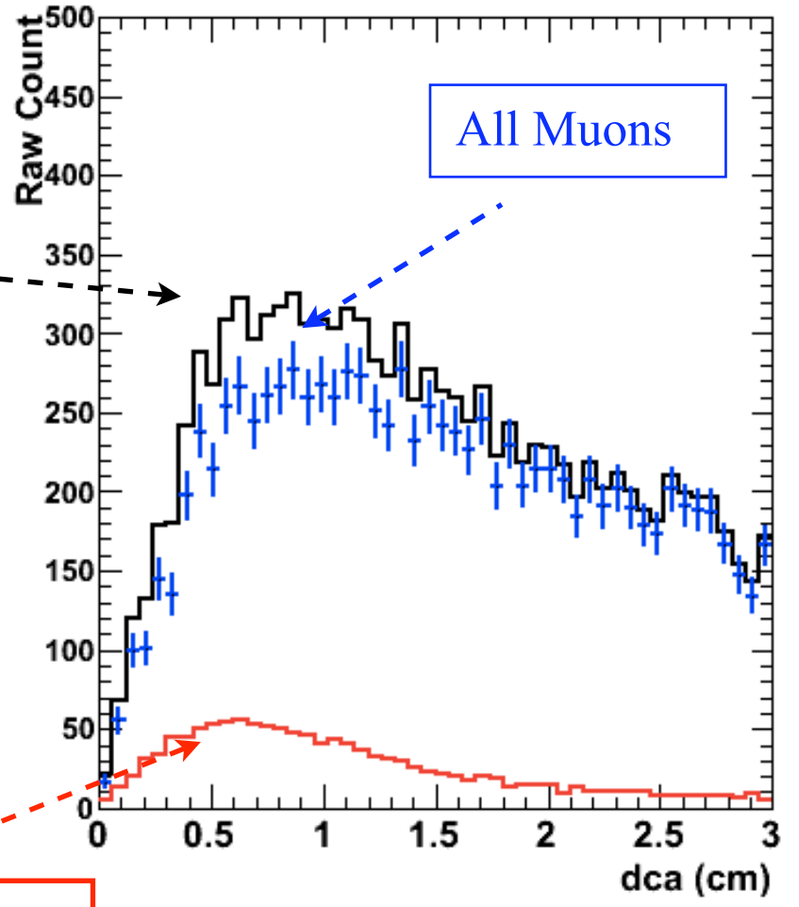
- Hijing 1.382 AuAu 200 GeV minbias 0<b<20 fm 40k events
- μ embedding data

Data Analysis

M^2 Spectra

DCA subtract



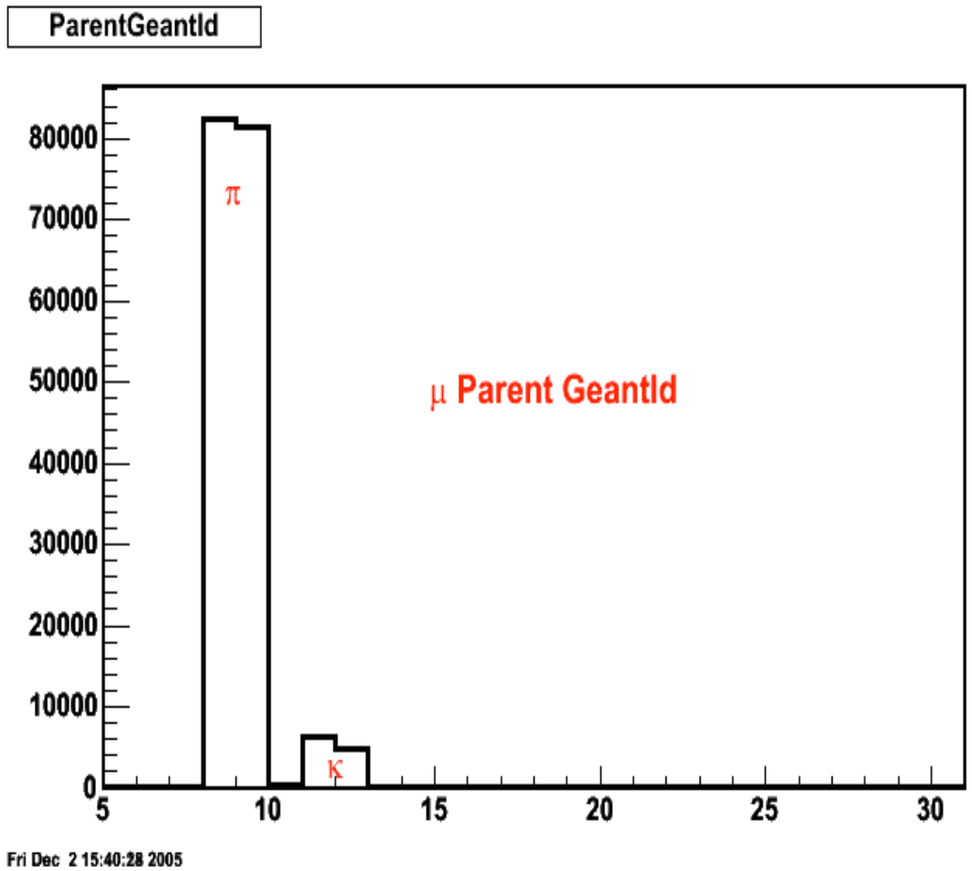


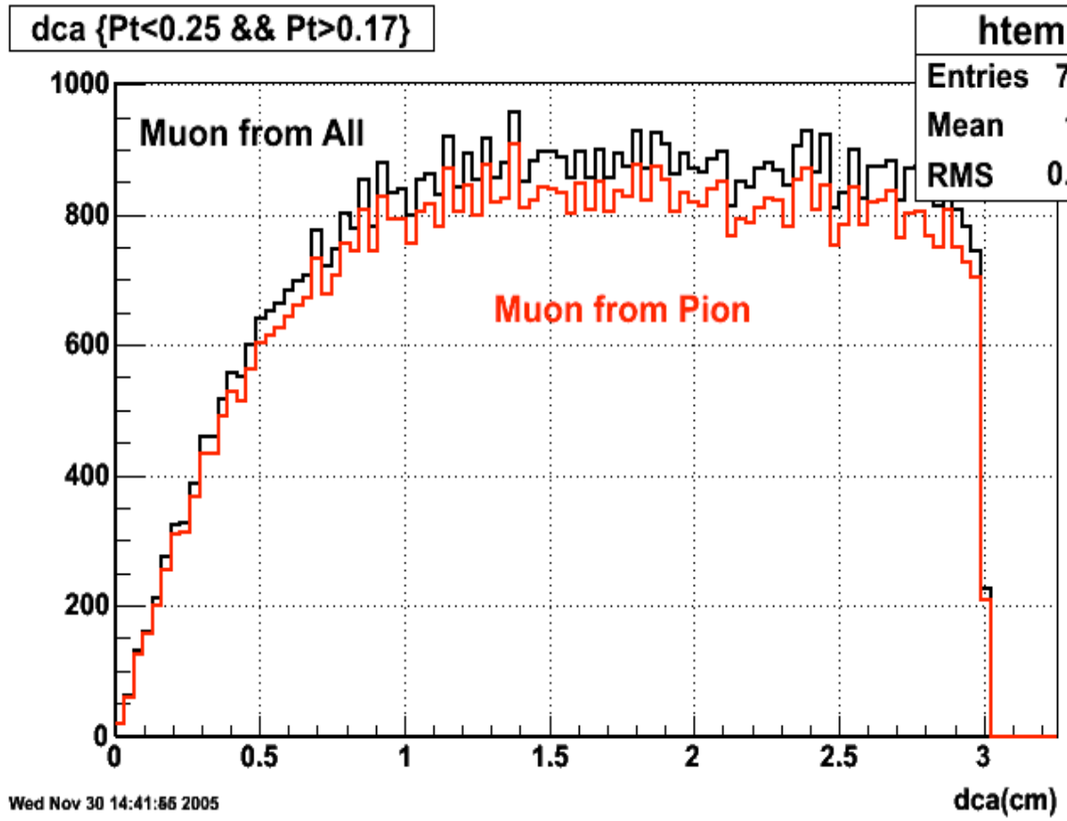
Low M2 Primary Pure Pion contamination

Data Analysis

AuAu 200GeV HIJING+Geant production

0~80% Min. Bias. & 0~12% Central





$\pi^{\pm} \rightarrow \mu^{\pm} + \nu_{\mu}$ HIJING Simulation

Data Analysis

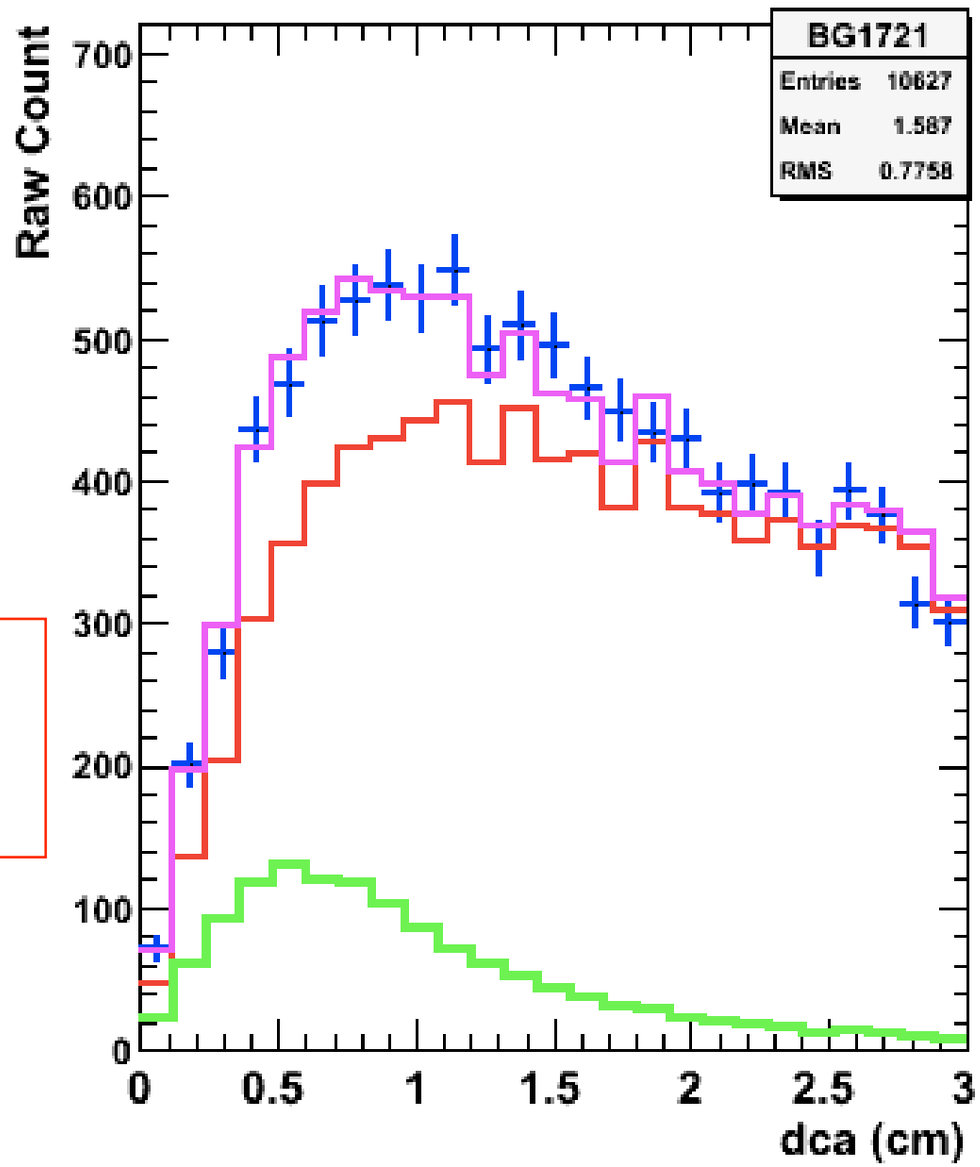
Histogram Fit

All Muons

the sum of Muon from Pion & Charm

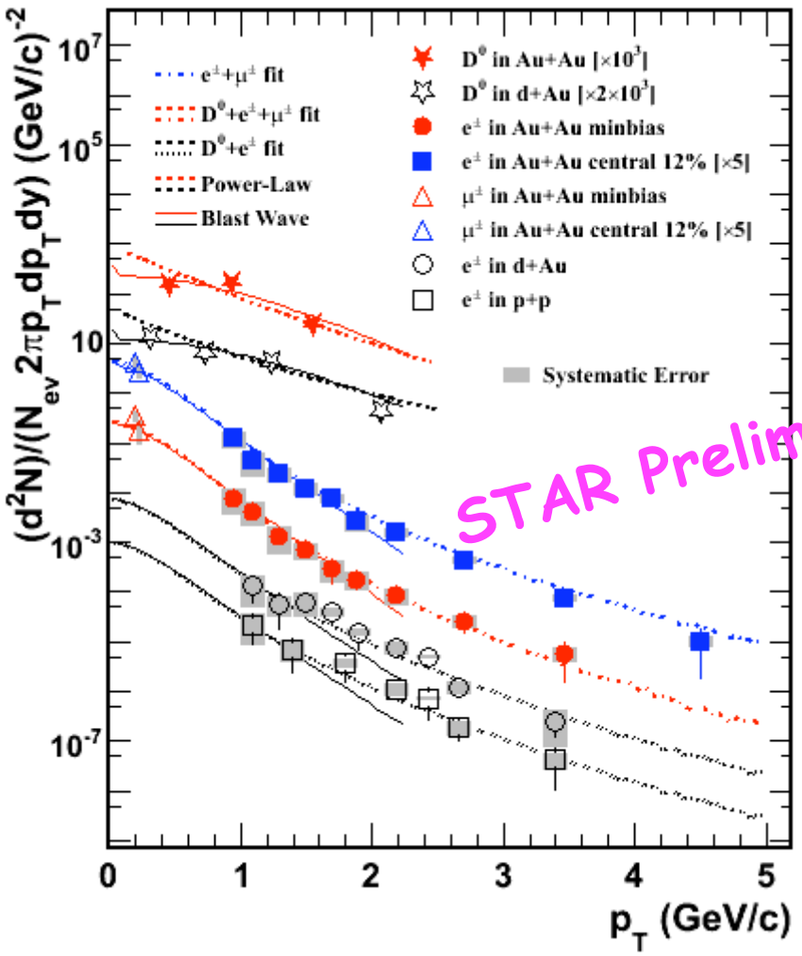
Muon from Pion (AuAu 200GeV HIJING+Geant production)

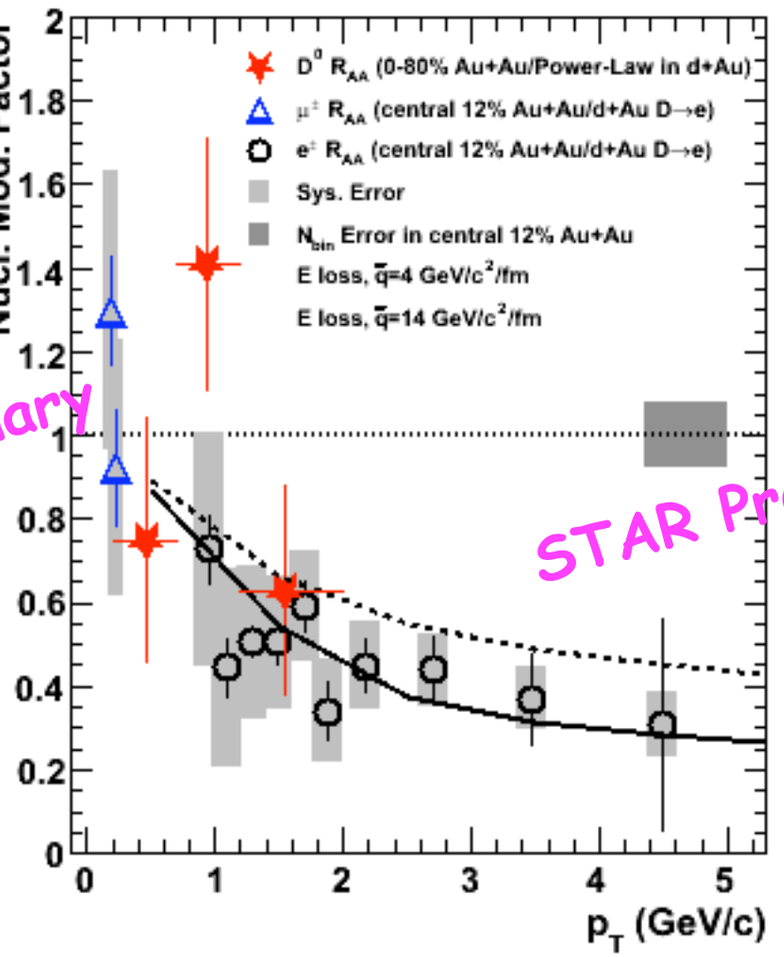
Muon from Charm (embedding data)

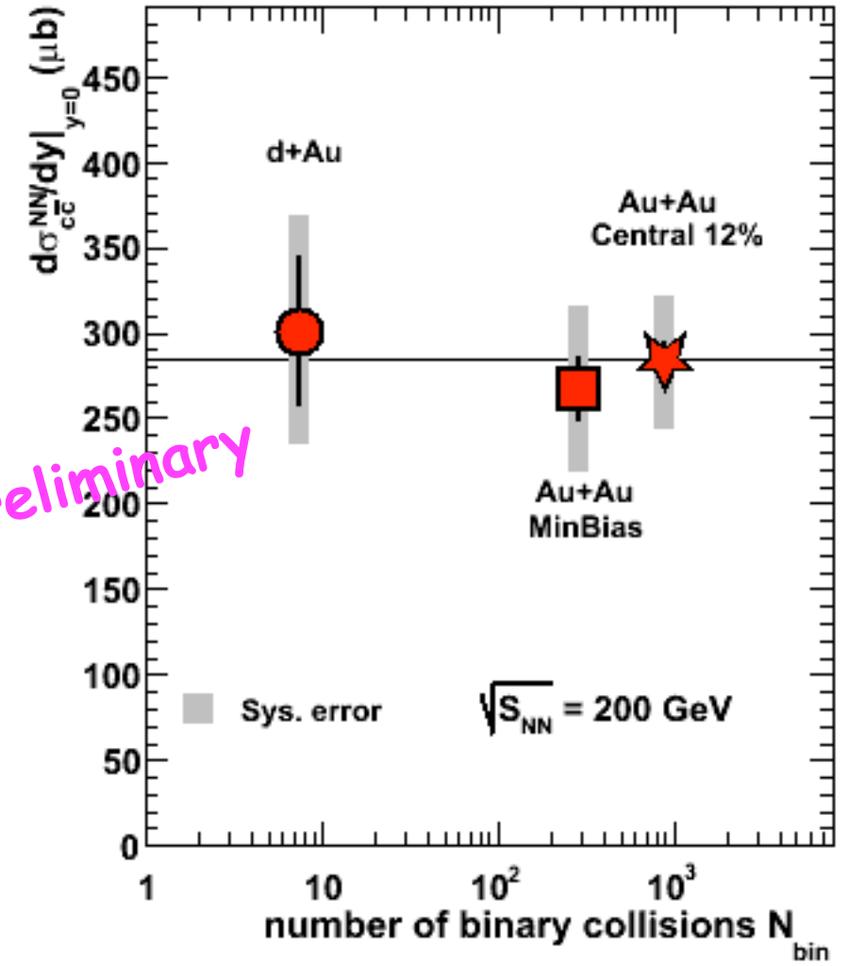


Background can't be removed event by event, but can be successfully dealt with statistical method

Results







With the moun measurement, the kinematic coverage for charm total cross section is larger than 90%, and the systematic error on the charm total cross section is a factor of 2 smaller.

Summary

- We present the first measurement of single muon spectra from charm decays at low P_t in 200 GeV Au+Au collision at STAR.
- The low P_t muon yields improve the determination of charm total cross section.
- The charm total cross section scales approximately with number of binary collisions.

Thank You